What Is Claimed Is:

1.   A finger print minutiae extraction method comprising:

acquiring fingerprint image data;

partitioning said fingerprint image data into at least one data block corresponding to a local area of said image data;

generating a histogram function of a contrast level of said image data corresponding to said data blocks; and

performing a histogram transformation of said histogram function,

wherein said histogram transformation is adapted to the contrast level of said local area of said fingerprint image data and pre-enhanced fingerprint image data is generated with local enhancement.

2.   The method of claim 1, further comprising:

partitioning said fingerprint image data into a plurality of data blocks, each of said plurality of blocks corresponding to a different local area of said image data and at least one of said plurality blocks having a contrast level different than a second of said plurality of data blocks,

wherein said histogram transformation is adapted to said different contrast levels of said plurality of blocks and pre-enhanced fingerprint image data is generated with local enhancement for a plurality of local areas of said image data.

3.   The method of claim 1, wherein said histogram transformation includes using an objective function with a relatively high value at both endpoints of an intensity interval and a relatively low value at a middle of said intensity interval.

4.   The method of claim 1, wherein noise and distortions in said image data are reduced.

5. The method of claim 1, wherein said histogram transform maps said histogram function to a specific function according to a mapping algorithm including

$$x \mapsto \arg\min_{y}\{y \mid \int_{0}^{x} g(t)dt < f(y)\}$$

wherein $f(x)$ is a target histogram function and said target histogram function has low value at the mid-point and has a high value at the endpoint of the interval.

6. The method of claim 1, further comprising:

performing orientation filtering on said pre-enhanced data using directional convolution for two dimensional digital image processing,

wherein said pre-enhanced image data is smoothed and enhanced.

7. The method of claim 6, wherein the following algorithm is used in said orientation filtering

$$g(i,j,k) = \sum_{l=1}^{M} f(i + y_{offset}(l), j + x_{offset}(l)) \times h(l).$$

8. The method of claim 1, further comprising:

thinning said fingerprint image data to remove false connections of ridges in said data,

wherein said thinning includes applying a first table and a second table to a plurality of pixels using an algorithm.

9. The method of claim 1, further comprising generating a first table and a second table using rules for character data and biological data.

10. The method of claim 9, wherein said rules for biological data include

If $P_1*P_7*P_8=1$ and $P_2+P_6>0$ and $P_3+P_5=0$ then $LUT_1(P)=0$;

If $P_5*P_6*P_7=1$ and $P_4+P_8>0$ and $P_1+P_3=0$ then $LUT_1(P)=0$;

If $P_1*P_2*P_3=1$ and $P_4+P_8>0$ and $P_5+P_7=0$ then $LUT_2(P)=0$; and

If $P_3*P_4*P_5=1$ and $P_2+P_6>0$ and $P_1+P_7=0$ then $LUT_2(P)=0$,

6   wherein A(P) is a number of 0-1 patterns in an order set P_1, P_2, P_3, P_4, P_5, P_6,

7   P_7, P_8, P_1, where P_i, i=1,... ,8, are 8-neighbors of a pixel in a clockwise direction, and

8   B(P) is a number of nonzero neighbors of P.

1   11. A method for fingerprint registration and verification from minutiae comprising:

2   performing a Hough transform on fingerprint image data and generating

3   evidences in lattice bins;

4   counting the evidences accumulated in said lattice bin;

5   shifting a lattice;

6   determining the number of evidences in each bin of said shifted lattice;

7   repeating said shifting and counting in each direction of said lattice until a

8   bin is completely overlapped with its diagonal neighbor,

9   wherein shifting the lattice enhances the spatial resolution of the Hough

10   transform.

1   12.   The method of claim 10, wherein said shifting said lattice occurs at a

2   predetermined step size.

1   13.   The method of claim 10, wherein said shifting the lattice partitions each

2   bin into blocks, each block is assigned a number equal to the number of evidences

3   in the corresponding bin, the numbers of the overlapped blocks are summed and

4   transform parameters are specified using the block that corresponds to the highest

5   sum.

1   14. The method of claim 10, further comprising:

2   determining the maximum number of evidence counts in the bins;

3   determining transformation parameters corresponding to the bins with the

4   maximum evidence counts;

5   determining the variance of said transformational parameters;

6   determining a matching score of a fingerprint image and a template

7   fingerprint image based on said variance of the transformational parameters and said

8   maximum number of counts.

15. The method of claim 13, wherein the matching score is determined using a sigmoid nonlinear function.

16. A system for biological data matching comprising:

an image reader for acquiring personal biological image data;

a template of biological image data;

a pre-enhancing unit adapted to pre-enhance said personal biological image data according to local and global areas of contrast;

an image smoothing and enhancement filter for enhancing said pre-enhanced image data;

an orientation data thinner for removing false data in said personal biological image data;

a registration unit for aligning said personal biological image data with said template image data; and

a matching score generating unit for determining if said biological data matches said template print.

17. The system of claim 15, wherein said personal biological image data and said temple image data include a fingerprint, iris, voice, hand geometry, face, or palm pattern.

1   18.   The system of claim 15, further comprising:

2   a database including a plurality of templates of biological image data,

3   wherein said system determines which template of said plurality of

4 templates in said database matches said personal biological image data.

1   19.   The system of claim 15, wherein said registration unit aligns said image

2 data with said template using a Hough transform and shifts a lattice to enhance the

3 spatial resolution of the Hough transform.

1   20. The system of claim 15, wherein said pre-enhancing unit enhances local

2 areas of contrast by partitioning said image data into image data blocks, generating

3 a histogram function of a contrast level of said image data corresponding to said

4 data blocks, and performing a histogram transformation of said histogram function.